

From the  
INTERNATIONAL SEARCHING AUTHORITY

To:

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PCT

WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY  
(PCT Rule 43bis.1)

Date of mailing  
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference  
see form PCT/ISA/220

**FOR FURTHER ACTION**  
See paragraph 2 below

International application No.  
PCT/GB2004/002668

International filing date (day/month/year)  
21.06.2004

Priority date (day/month/year)  
21.06.2003

International Patent Classification (IPC) or both national classification and IPC  
H02K5/132, H02K9/19, F04D13/10

Applicant  
WEATHERFORD/LAMB, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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IAP20 Rec'd PCT/PTO 21 DEC 2005

**Box No. I Basis of the opinion**

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.  
☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material:  
☐ a sequence listing  
☐ table(s) related to the sequence listing
  - b. format of material:  
☐ in written format  
☐ in computer readable form
  - c. time of filing/furnishing:  
☐ contained in the international application as filed.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

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**Box No. II    Priority**

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1. ☒ The following document has not been furnished:☒ copy of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(a)).☐ translation of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(b)).

Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.3. ☐ It has not been possible to consider the validity of the priority claim because a copy of the priority document was not available to the ISA at the time that the search was conducted (Rule 17.1). This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

4. Additional observations, if necessary:

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PCT/GB2004/002668**Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

- ☐ the entire international application,  
☒ claims Nos. 6-26

because:

- ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):
- ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):
- ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.
- ☒ no international search report has been established for the whole application or for said claims Nos. 6-26
- ☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:
- the written form ☐ has not been furnished  
☐ does not comply with the standard
- the computer readable form ☐ has not been furnished  
☐ does not comply with the standard
- ☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-bis of the Administrative Instructions.
- ☐ See separate sheet for further details

**WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY**International application No.  
PCT/GB2004/002668**Box No. IV Lack of unity of invention**

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees, the applicant has:
- ☐ paid additional fees.
  - ☐ paid additional fees under protest.
  - ☒ not paid additional fees.
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is
- ☐ complied with
  - ☒ not complied with for the following reasons:  
**see separate sheet**
4. Consequently, this report has been established in respect of the following parts of the international application:
- ☐ all parts.
  - ☒ the parts relating to claims Nos. 1-5

**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

## 1. Statement

Novelty (N)	Yes: Claims	1-5
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-5
Industrial applicability (IA)	Yes: Claims	1-5
	No: Claims	

## 2. Citations and explanations

**see separate sheet**

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**Re Item IV.**

AP20 Rec'd PCT/PTO 21 DEC 2005

The separate inventions/groups of inventions are:

**Invention I (claims 1-5)**

A downhole electric motor having a permanent magnet rotor and a stator with windings in closed slots. The windings are cooled in the slots.

**Invention II (claims 6-12,13-20)**

A downhole electric motor having a stator being made up of first and second concentric parts which together define the slots in the stator so as to permit the phase windings to be fitted to the first part prior to fitting of the second part to enclose the phase windings within the slots.

**Invention III (claims 21-23)**

A downhole electric motor having two multiple-phase sections being supplied with electrical power from the surface by separate supply leads.

**Invention IV (claims 24, 25)**

A method of constructing the phase coils of a downhole electric motor.

**Invention V (claim 26)**

A permanent magnet motor having permanent magnets provided with an anti-corrosion coating.

The reasons for which the present application has been deemed to contain 5 inventions which are not linked such that they form a single general inventive concept, as required by Rule 13.1,13.2 and 13.3 PCT are as follows:

The closest prior art has been identified as document D1 (US-B-6388353) which discloses a downhole electric motor (cf. column 3, line 60 - column 4, line 44).

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**Invention I (claims 1 - 5):**

From a comparison of the disclosure of this prior art D1 and the technical features of claim 1 the features which are known from D1 are the following:

- A downhole electric motor (16) (column 1, lines 6 - 9)
- having at least three phases and comprising a permanent magnet rotor (58) (column 2, lines 62 - 65) and
- a stator (52) bearing phase windings (54) in slots in the stator (column 4, lines 2 - 7),
- each phase winding (54) incorporating a plurality of coils each extending through a respective pair of closed stator slots (Fig.3)

from which analysis follows that the following technical features of claim 1 can be seen to make a contribution over this prior art:

- the coils surrounds a respective portion of the stator between the stator slots (not explicitly mentioned in D1) and
- adjacent coils of different phases extending through opposite parts of a respective one of the stator slots.

From these features the objective problem to be solved by the first invention can be construed as:

How to install the different stator coils in the stator slots.

**Invention II (claims 6 - 12 and 13 - 20):**

From a comparison of the disclosure of the prior art D1 and the common technical features of independent claims 6 - 9 and 13 - 14 the features which are known from D1 are the following:

- A downhole electric motor (16) (and a method of constructing it) (column 1, lines 6 - 9)
- having a rotor (58) and a stator (52) bearing phase windings (54) in slots in the stator (column 4, lines 2 - 7),

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from which analysis follows that the following technical features of independent claims 6 - 9 and 13 - 14 can be seen to make a contribution over this prior art:

- the stator being made up of first and second concentric parts which together define the slots in the stator so as to permit the phase windings to be fitted to the first part prior to fitting of the second part to enclose the phase windings within the slots.

From these features the objective problem to be solved by the second invention can be construed as:

How to form the stator of an electric motor.

**Invention III (claims 21 - 23):**

From a comparison of the disclosure of the prior art D1 and the technical features of independent claim 21 the features which are known from D1 are the following:

- A downhole electric motor (16) (column 1, lines 6 - 9)
- having a first multiple-phase section (column 2, lines 62 - 65)

from which analysis follows that the following technical features of claim 21 can be seen to make a contribution over this prior art:

- a second multiple-phase section and
- separate supply leads for supplying said first and second sections with electrical power from the surface.

From these features the objective problem to be solved by the third invention can be construed as:

How to group the windings of an electric motor and supply them with electrical power.

**Invention IV (claims 24 - 25):**

From a comparison of the disclosure of the prior art D1 and the technical features of independent claim 24 the features which are known from D1 are the following:

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- A method of constructing a downhole electric motor (16) (column 1, lines 6 - 9)
- having a rotor (58) and a stator (52) bearing phase coils (54) in slots in the stator (column 4, lines 2 - 7),

from which analysis follows that the following technical features of claim 24 can be seen to make a contribution over this prior art:

- the method comprising the step of fitting open ended conductive loops within the slots in the stator, and
- closing the conductive loops to form the phase coils.

From these features the objective problem to be solved by the forth invention can be construed as:

How to manufacture the phase coils of an electric motor.

**Invention V (claim 26):**

From a comparison of the disclosure of the prior art D1 and the technical features of independent claim 26 the features which are known from D1 are the following:

- A permanent magnet motor (16) (column 1, lines 6 - 9)
- having a rotor (58) provided with permanent magnet means (74) (column 4, lines 28 - 30) and
- a stator (52) coaxial with the rotor (58) (column 4, lines 8 - 10),

from which analysis follows that the following technical features of claim 26 can be seen to make a contribution over this prior art:

- wherein the permanent magnet means is provided with an anti-corrosion coating.

From these features the objective problem to be solved by the fifth invention can be construed as:

How to form the rotor of an electric motor.

The five identified inventions do not share any common special technical features within

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the meaning of Rule 13.2 PCT, because as the analysis clearly shows, the above identified features of invention I establishing a difference to the closest prior art are neither the same as nor corresponding to those of invention II, nor the same as or corresponding to those of invention III, nor the same as or corresponding to those of invention IV, nor the same as or corresponding to those of invention V.

Also examining the possible correspondence by technical effect, one finds the technical effect of :

- invention I to be the possibility of providing cooling means between the windings in the slots,
- invention II to be the possibility of providing the stator with prefabricated coils,
- invention III to be the provision of a fault-tolerant downhole electric motor,
- invention IV to be the easy manufacturing of coils for stators having closed slots,
- invention V to be the possibility of using the motor in an aggressive environment.

This appears to show lack of corresponding technical effect as well. Consequently, neither the objective problem underlying the subjects of the three claimed inventions, nor their solutions defined by the technical features allow for a relationship to be established between the said inventions, which involves a single general inventive concept.

In conclusion, therefore, the five groups of claims are not linked by common or corresponding special technical features and define five different inventions not linked by a single general inventive concept. The application, hence does not meet the requirements of Unity of Invention as defined in Rules 13.1 & 13.2 PCT.

If the applicant pays additional fees for one (or more) not yet searched group(s) of invention(s), then the further search(es) may reveal further prior art that gives evidence of a further lack of unity 'a posteriori' within one (or more) of the not yet searched group(s). In such a case only the first invention in this (each of these) group(s) of inventions, which is considered to lack unity of invention, will be the subject of a search. No further invitation to pay further additional fees will be issued. This is because Article 17(3)(a) PCT stipulates that the ISA shall establish the International Search Report on those parts of the international application which relate to the invention first mentioned in the claims ('main invention') and for those parts which relate to inventions in respect of which the additional fees were paid. Neither the PCT nor the PCT guidelines provide

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a legal basis for further invitations to pay further additional search fees (W17/00, point 11 and W1/97, points 11-16).

**Re Item V.**

- 1) The following documents are referred to in this communication:  
D1 : US 6 388 353 B1 (LIU JOSEPH C ET AL) 14 May 2002 (2002-05-14)  
D2 : EP 1 102 383 A (NISSAN MOTOR) 23 May 2001 (2001-05-23)  
D3: DE 28 26 607 A (BBC BROWN BOVERI & CIE) 29 November 1979 (1979-11-29)
- 2) The present application does not meet the criteria of Article 33(1) PCT, because the subject matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT.

Document D1, which is considered to represent the most relevant state of the art to the subject matter of claim 1, discloses (the references in parenthesis applying to this document):

- A downhole electric motor (16) (column 1, lines 6 - 9)
- having at least three phases and comprising a permanent magnet rotor (58) (column 2, lines 62 - 65) and
- a stator (52) bearing phase windings (54) in slots in the stator (column 4, lines 2 - 7),
- each phase winding (54) incorporating a plurality of coils each extending through a respective pair of closed stator slots (Fig.3)

from which the subject-matter of claim 1 differs in that:

- the coils surrounds a respective portion of the stator between the stator slots (not explicitly mentioned in D1) and
- adjacent coils of different phases extending through opposite parts of a respective one of the stator slots.

The problem to be solved by the present invention may therefore be regarded as how to install the different stator coils in the stator slots so that cooling means may be provided in the slots between the windings.

In view of D2 the solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following

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reasons:

The solution proposed in claim 1 has already been employed for the same purpose in a similar motor, see document D2, column 3, lines 1 - 45. It would be obvious to the person skilled in the art, namely when the same result is to be achieved, to apply these features with corresponding effect to a motor according to document D1, thereby arriving at a Motor according to claim 1.

- 3) Dependent claims 2 - 5 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).

✓ The features of dependent claim 2 have already been employed for the same purpose in a similar motor, see document D2, column 3, lines 1 - 45. It would therefore be obvious to the person skilled in the art, to apply these features with corresponding effect to a motor according to document D1, thereby arriving at a motor according to claim 2.

The same applies also to claim 3 taking into consideration document D1 and D3.

In claims 4 and 5 slight constructional changes in the motor of claim 1 is defined which comes within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved can readily be foreseen. Consequently, the subject-matter of claims 4 and 5 also lacks an inventive step.

- 4) With reference to his letter dated 12 July 2004 the applicant is informed that the missing figure Fig.31 cannot be constructed unambiguously from the explanations given in the description. Therefore Fig.31 cannot be reinstated without adding any further subject matter to the application as originally filed (Article 19(2) and 34(2)(b) PCT).